DOCUMENT RESUME

ED 385 233 IR 017 244

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TITLE Computer Archives and the Literature Search.
PUB DATE Mar 95
NOTE 26p.; Paper presented at the Annual Meeting of the American Educational Research Association (San Francisco, CA, April 18-22, 1995).
PUB TYPE Guides - Non-Classroom Use (055) -- Speeches/Conference Papers (150)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Access to Information; Archives; Bibliographies; *Computer Networks; Databases; Education Majors; Electronic Mail; Evaluation Methods; Information Literacy; Information Networks; *Information Retrieval; *Online Searching; *Online Systems; Reference Materials; Reference Services; Resources; *Search Strategies; User Needs (Information)
IDENTIFIERS *Internet

ABSTRACT

This paper outlines the use of computer resources to conduct a literature search. While the phrase "computer archives" can refer to all computerized materials, for this discussion it is limited to textual information available online. Both commercial online services and organizations on the Internet offer files to search and download. In addition, thousands of discussion groups allow members to post notices that may contain information. Locator tools for electronic documents at present consist of print-like tools such as indexes and bibliographies, multifile keyword indexes, and unifile keyword search tools. The use of each to retrieve information is outlined. Once retrieved, information must be evaluated. The uneven nature of documentation in computer archives makes evaluation even more essential than for print resources. Computer access opens new prospects for students, and its potential is particularly apparent in the field of education. Some suggestions are given for teaching students of education to search computer archives, with descriptions of the ERIC system, the Archie and Veronica search tools, and 15 sample screens. An appendix lists search steps. (Contains 11 references.) (SLD)

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American Educational Research Association March, 1995

COMPUTER ARCHIVES and the LITERATURE SEARCH

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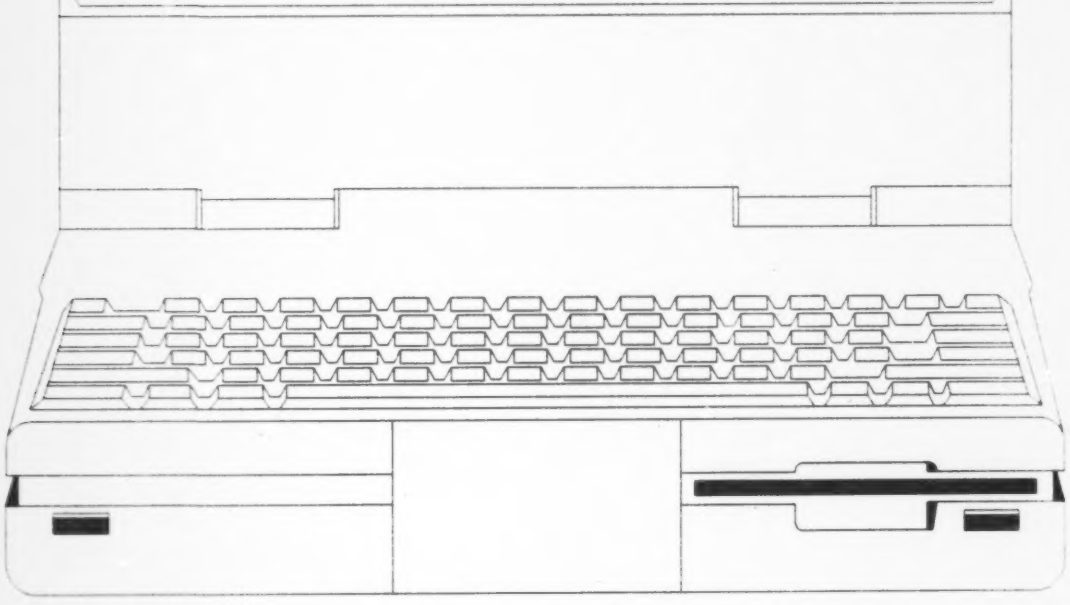

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COMPUTER ARCHIVES

AND THE LITERATURE SEARCH

Computers not only enable us to store old information in new ways; they also create new forms of information. How do these new forms of information impact the teaching of research? Specifically, where do they fit—or do they fit—into the framework of a literature search?

THE LITERATURE SEARCH

The path, or network, traced in a literature search is determined by interaction of three factors: the purpose of the search, the forms and content of the record of scholarship, and the scope of available search tools. Given this complexity, no wonder that searchers do not proceed directly from question and answer. Rather, the process is recursive, as Penland found some years ago in a study of adult seekers of information (1976). He showed that as searchers find new terms, new sources, and new avenues of inquiry, they inevitably double back, revisiting indexes and sources.

The inquiry may be practical or theoretical. The searcher may seek ideas or justification for a new program, rationale for a budget or grant proposal, a methodological framework or instrument for an evaluation design—or a comprehensive base for new research. However, to simplify this discussion and adhere to our interests as teachers of research, I assume that a graduate student is consulting the community of scholarship because he or she must write a paper or research proposal for a course in education.

So the student seeks something on a given topic. To find something . . . that is not difficult. But as professors, we do not want students to find "something." We want them to find the basic material in the field, the most thoughtful pieces on philosophy or theory, and the most competent research. Ideally, these "best" items would be selected from the whole body of literature.

Such a comprehensive collection of information resources requires that the literature search itself follow the elements of research design. Cooper (1989) adapts those elements to an integrative research review by proposing these stages:

- problem formulation
- data collection
- data evaluation
- analysis and interpretation, and
- public presentation.

The present discussion focuses on the second step, data collection, which I have divided into three substages (always accepting the likelihood that a searcher is likely to circle back, as Penland described). These substages are:

- generating search strings,
- finding citations, and
- retrieving resources.

(For a more detailed checklist, see the appendix to this paper.)

This process has only become more complex with the advent of computerized indexes and fulltext, as well as the Internet. In particular, we hear much about the Internet, the "information superhighway." We picture a searcher at a computer, finding and retrieving anything that has ever been printed, indeed, recorded in any form. Thomas Mann, reference librarian at the Library of Congress, describes the "Computer Workstation model" this way:

> . . . "everything"—a "virtual library," or "the entire Library of Congress"—will be available immediately and completely to anyone with access to such a workstation. Gone would be the need to travel to a library; instead, the "electronic library" would be available anywhere, to anyone with access to the inexpensive equipment needed to tap into it (1993, p. 103).

This view imagines that the materials housed on the 500+ miles of shelving at the Library of Congress are accessible as one sits before a desktop computer. However, Mann points out several serious barriers that must be overcome before this dream can be realized. Among these are limitations in technology, time, labor, and budgets; authors' and publishers' copyright privileges and their expectation of earning a profit; and the difficulties of "bibliographic control," by which librarians mean the classification and cataloging systems that enable us to retrieve material on a topic, regardless of the terminology or format of a particular writer (1993, pp. 131-40).

Whether or not the Computer Workstation can be realized in the future, it is not available today. Yes, some fulltext is online; some indexes are computerized, although they rarely extend backward in time more than twenty years or so; and some documents have been "published" solely in electronic format. These latter may run to a few million documents, some of them duplicates of one another, but to keep things in perspective, note that the Library of Congress alone holds over a hundred million items (Progress, 1994, p. 19). Nevertheless, because many computer files are otherwise unavailable, they should not be overlooked in a search of the literature even though, once they have been evaluated, some may be found "unworthy" for the researcher's purpose.

COMPUTER ARCHIVES

From *Webster's Third* we conclude that "archives" consist of

> public or institutional records (as minutes, correspondence, reports, accounts), historic documents (as diaries, photographs, private correspondence), and other materials that have been preserved (1981, vol. 1, p. 113).

With respect to information in computerized form, the term is broadly construed, sometimes encompassing not only "other materials," but *all* computerized materials. In other words, the phrase "computer archives" may refer to any files—text, video and audio images, or software programs—preserved on computers or computer disks. For this discussion, however, I limit "computer archives" to textual information available online.

Online computerized text may be divided into two major categories: those documents also available in printed form and those offered only in electronic formats. As to the former, only a very small proportion of printed texts is duplicated in online files. These files include a few books, most of them old enough to fall outside copyright restrictions; back issues of selected newspapers and magazines; and teaser chapters from new books, usually related to computer technologies. These documents present no particular difficulties in a literature search, since they can be located and retrieved with procedures already familiar to us. The computer only provides an alternate avenue of access.

Files available exclusively in electronic formats, on the other hand, pose new problems for a literature search. What sorts of files are offered? Where? How may they be located? How retrieved, evaluated, and cited?

What and Where?

Both commercial online services (such as America Online and CompuServe) and organizations on the Internet (including universities, libraries, professional associations, and special interest groups of all persuasions) offer files to be searched and/or downloaded. For example, *Education Policy Analysis Archives*, which describes itself as an "all-electronic, peer-reviewed, scholarly journal devoted to the analysis of education policy at all levels and throughout the world," operates as a listserv with the Internet address LISTSERV@ASU.EDU. An inventory of available articles may be obtained by e-mail to the listserv, sending the message INDEX EDPOLYAR F=MAIL. The journal is edited by Gene V. Glass of the Division of Educational Leadership & Policy Studies at Arizona State University.

In addition, thousands of discussion groups—also known as bulletin boards, conferences, forums, listservs, mailing lists, and newsgroups—allow their members to post notices in which they ask questions, offer answers, provide information, and so on. For example, in addition to the journal archives just described, Arizona State University sponsors a discussion group called "EDPOLYAN." Subscribers may post notes or papers, ask and answer questions, or announce jobs, meetings,

conferences, and publications. Postings are distributed to all subscribers. Thus, anyone who belongs to the group and saves its messages has a personal archive of the listserv. In addition, this particular listserv is archived for the public. That is, all messages sent to EDPOLYAN are saved on a computer at the University of Arizona. To obtain a list of archive files, one sends the message INDEX EDPOLYAN to the listserv.

Papers from professional conferences, online debates, and other proceedings also appear online. For instance, many papers from this AERA Conference are available from LISTSERV@UNB.CA. A subscriber may even participate in live electronic debates during the course of the conference. One subscribes by sending the listserv an e-mail message reading SUBSCRIBE AERA-VC YourFirstName YourLastName. This is the second year AERA has been involved with a "virtual conference"; moreover, papers from the 1994 conference may still be retrieved if you have access to Lynx, Mosaic, or another Internet program that accepts Universal Resource Locators (URLs). The URL is http://www.digimark.net/educ/WWW/enet/prog.html.

(Details on selected Internet features are woven into the teaching demonstrations later in this paper. Further information may be obtained from online documents and in any of several helpful books about commercial services and the Internet.)

How Located and Retrieved?

All very well to know that books and articles are available via modem or Internet connection; to know that America Online offers articles from *Educational Leadership*, that CompuServe houses the text of some 30 major newspapers for recent years, that GTE Educational Network provides fulltext of *Education Week*, or that the Internet offers all of Shakespeare. Still, while obtaining such documents in computerized form allows one to search, edit, and quote them more readily than their print analogs, one can still obtain them by going to the library.

But what about those millions of electronic-only documents located on computers somewhere in "cyberspace"? Perhaps browsing the menus at a favorite commercial service or "surfing" the Internet are pleasant recreational activities, but when searchers need information, they need it promptly. Moreover, they want a systematic way of finding it, rather than to depend upon luck. Fortunately, searching is a task computers can do well, if someone creates suitable programs. At present, locator tools for electronic documents include (1) print-like tools such as indexes and bibliographies, (2) multifile keyword indexes, and (3) unifile keyword search tools.

Print-Like Tools

Indexes and bibliographies have been developed to assist researchers in locating online information. Some of these are published in book form. One might consult any of the following:

Gale Directory of Databases
Gale Directory of Portable Databases
Directory of Electronic Journals, Newsletters, and Academic Discussion Lists (Association for Research Libraries)
On Internet 1994: An International Guide to Electronic Journals, Newsletters, Books, & Discussion Lists on the Internet (Mecklermedia).

Note that while the first two directories list commercial services, the last two deal only with the Internet. Moreover, except in the case of electronic books, they do not identify individual files, but groups of files. Nor do they search the contents of the files. One consults them to find groups of documents that are likely to contain relevant information.

In addition, electronic bibliographies list electronic documents. Two important repositories are located at the University of Michigan and Syracuse University. The former has set aside computer space for a Clearinghouse of Subject-Oriented Bibliographies, reachable through the Internet using File Transfer Protocol at the address una.hh.lib.umich.edu. Included are lists of Internet resources on adult learning, aerospace engineering, agriculture, and architecture, to name a few. Any of these bibliographies may also be retrieved through Gopher, a more user-friendly approach. (Instructions for File Transfer Protocol, Gopher, and other Internet tools lie beyond the scope of this paper, except to the extent that they are included in the demonstrations with which the paper concludes, but they are explained in numerous online and printed sources.)

The bibliography resource at Syracuse University is a set of ERIC InfoGuides. These guides are best reached through the Gopher at your Internet provider or by way of America Online. File Transfer Protocol to ericir.syr.edu is a more difficult, but possible, avenue. Narrower in scope than the subject-oriented bibliographies at the University of Michigan clearinghouse, all InfoGuides deal with education. Sample topics include African history, AIDS education, authentic assessment, and autism.

Multifile Keyword Indexes

Bibliographies are compiled by human beings. But computers are themselves capable of searching across multiple files and databases. Such programs usually look for keywords, rather than standardized descriptors or subject headings. Unfortunately, if the person who named the file used different terminology than the searcher has in mind (perhaps "guidance" rather than "counseling"), that file will be missed. Conversely, if a filename contains a word that has a different meaning (for example, "counselor" meaning attorney, rather than "counselor" in a school), the search will garner false hits. Nevertheless, if one is both inventive and patient, useful information may be located.

Commercial vendors usually provide a means of locating files or services of interest. In CompuServe, for instance, one just enters FIND followed by a keyword. Various services, including forums (discussion groups), then appear on the computer screen and may be selected. In America Online a similar search tool is obtained by selecting the Directory of Services under Members' Online Support.

The Internet provides several multifile search tools. These have been developed by special interest groups and by volunteers and made available without charge. Of these, the most comprehensive are archie, Veronica, and the Web searchers (WebCrawler or World Wide Web Worm). Each of these is a software program that allows a searcher to enter a keyword or phrase, then scans filenames or menus to find matching items.

The first, archie, is an index to filenames and directory titles on computers that offer File Transfer Protocol. Every 30 days archie works its way through all the text and software files available for downloading from the Internet. The most efficient way to search archie is by e-mail. Once archie has completed its work, the searcher chooses files of interest, accesses each computer location, and issues appropriate commands to retrieve the file. An archie example is provided below.

What archie does for file transfer sites, Veronica does for Gophers. File and directory names on a Gopher are not limited to the abbreviated formats required by a computer, but appear in full, natural language phrases. Veronica periodically searches these file and directory names and keeps track of their location. Moments after a searcher enters a term, a list of matching file and directory names comes up on the screen. When the list appears, the searcher selects any relevant item and is immediately connected to the computer holding the file, no matter where on earth it may be. Pressing the = key directs that Gopher to show its address so one can return later. Or, pressing the letter a puts the item (capital A puts the entire menu) on a personal "bookmark," or list of valuable Gopher locations. Each individual's bookmark is maintained on his or her host computer for subsequent use. A Veronica search is shown below.

Finally, what Veronica does for Gophers, WebCrawler and World Wide Web Worm do for the World Wide Web. Using a tool that accepts URLs, one accesses the Web Crawler at http://www.biotech.washington.edu/WebCrawler/WebQuery.html and World Wide Web Worm at http://www.cs.colorado.edu/home/mcbryan/WWWW.html. Since these tools are new and somewhat limited in availability, they are not illustrated here.

Internet search tools sometimes turn up archives of electronic journals, but I have not found discussion groups, probably because their archives are named by the brief-form names of the groups themselves, rather than with full words. I can find the archives only if I already know the group name. To discover a group name, I might turn to directories of these newsgroups, listed above in the section on print-like tools.

However, three online approaches are also available on the Internet. First, the directory published in print by the Association of Research Libraries may also be searched online via the Gopher at the University of Saskatchewan, whose address is gopher.usask.ca. Online, the title is *Directory of Scholarly Electronic Conferences*.

A second way to find relevant discussion groups is to go to the list of newsgroups (perhaps called conferences) on an Internet provider. At last count these newsgroups numbered three to four thousand. Once the list is on the computer screen, the searcher types the forward slash (/) followed by a keyword to search through the list for possible groups.

Third, to find relevant listservs, one sends e-mail to LISTSERV@BITNIC.BITNET with the message LIST GLOBAL/TOPIC. The word TOPIC is replaced by the searcher's keyword.

After joining a discussion group, one can capture messages as they are posted, creating a personal archive of the newsgroups or listserv. In addition, although newsgroups rarely keep their messages for a long period of time, listservs frequently create public archives, as does the EDPOLYAN group mentioned earlier. This brings us to the procedure for searching such archives.

Before turning to that procedure, however, one more category of computer resources should be noted. This category consists of individual bulletin boards reached not through major commercial vendors nor through the Internet, but by direct dial. Some are free public services operated by volunteers; others are commercial ventures. They cover everything from religion to pornography, from cooking to poetry (as does the Internet). Such bulletin boards are listed in issues of *Online Access* and regional computer magazines; they may also appear in the yellow pages of local telephone directories (perhaps under "Computer Bulletin Boards").

Unifile Keyword Search Tools

Once a computer file or group of files has been accessed, it may offer its own search "engine." On a Gopher menu, such an indexed file is marked with the symbol <>. As just noted, the *Directory of Scholarly Electronic Conferences* is searchable online; the Clearinghouse of Subject-Oriented Bibliographies also lists a search option on its menu. The searcher simply selects that option and follows directions on the computer screen.

The archives of a discussion group are less approachable. They resemble a collection of documents stuffed into a file cabinet in straight chronological order. Some groups have existed for several years now, and have accumulated extensive archives. One could, of course, download the whole lot, then use a word processor or search program. However, in most cases a more efficient approach is to search the archive online.

As just noted, listservs frequently archive their files, whereas most other discussion groups restrict their backfiles to a few weeks. Once a relevant discussion group has been identified, an e-mail message to the listserv address with the message INDEX followed by the name of the group will yield, if the listserv is indexed, its list of files. However, these files generally bunch messages for a week or month. To get to individual messages, one sends another e-mail message to the listserv address:

```
//
Database Search DD=Rules
//Rules DD *
Search topic in groupname
Index
/*
```

Of course, the searcher's own keyword is entered in place of "topic" and the name of the discussion group replaces "groupname." Back comes a list of message numbers and titles. Again, e-mail instructions direct the distant computer to e-mail a desired message to the searcher's own e-mail box. The message looks like this:

```
//
Database Search DD=Rules
//Rules DD *
Search topic in groupname
Print all of #
/*
```

Again, topic and groupname are provided by the searcher. In addition, this time # is replaced by the number of the document one wishes to receive. Soon the message is received into the searcher's e-mail box on his or her host computer. (For a valuable resource on Internet search tools, see the Gilster title cited at the end of this article.)

How Evaluated?

As Hamlet said, "Ay, there's the rub!" After having engaged in all this activity to locate and retrieve files from computers around the world, how shall we evaluate them? Anyone with a computer and modem or Internet access can post files. Peer-reviewed, university-sponsored, scholarly electronic journals like *Education Policy Analysis Archives* are still the exception, rather than the rule. On the other hand, many files include information to help us judge their value: author, date, organizational affiliation, review process (if any). Again, discussion groups are the most problematic among computer files, since they are usually intended to be open forums. Some are moderated, that is, one or a few individuals take responsibility for monitoring the postings. Often, however, the criteria are designed more to keep messages relevant to the purpose of the group, rather than to block inaccurate or even offensive material. Other groups are unmoderated, leaving to members of the group whatever steps individuals might wish to take if they are perturbed by something that has been posted. The researcher does well to check for followup messages as one means of checking the veracity of any given item. For example, my e-mail box recently presented me with a plea not to buy products from a particular corporation accused of an unethical position on a political issue. A day later came an apology for having forwarded the message without verifying the truth and currency of the accusation.

As in any piece of research, material gathered in a literature search must be evaluated as to truth and relevance. We all encounter students, even at the university level, who tend to accept information just because it appears in print. For some, the seeming magic of the computer only adds to that aura. In fact, however, the uneven nature of documentation in computer archives provides object lessons in the importance of evaluating information on internal and external criteria.

How Cited?

Recent style manuals include instructions for citing electronic documents. The fifth edition of Kate Turabian's *A Manual for Writers of Term Papers, Theses, and Dissertations*, published in 1987, mentioned documents retrieved from commercial services and ERIC. Since then the Internet has become readily accessible; consequently, the 1994 edition of the style manual of the American Psychological Association (APA) addresses online abstracts, journal articles, databases, and software—drawing in turn from Li and Crane's *Guide to Citing Electronic Information* (1993).

According to the APA manual, incidentally, electronic correspondence such as e-mail messages and conversations via bulletin boards and electronic discussion groups should be cited like personal communications (p. 218). I believe, however, that when such material is archived, it would best be treated as FTP-able computer files.

Two elements are essential to document electronic materials. First is an indication of the medium itself, as APA shows a bracketed phrase like [On-line serial]. Second is information sufficient to enable another researcher to access and retrieve the file. For example, a reference to John December's *Internet Tools Summary* might conclude with FTP: rpi.edu Directory pub/ communications/internet-tools.

This information enables one to use File Transfer Protocol to access the ftp site rpi.edu, then change directories to pub, then to communications, and finally "get" the document internet-tools. Whatever

style manual one uses, this information must be worked into the entry in a format consistent with entries for analogous printed material.

An unresolved issue is how one refers to page numbers. In most cases page separations are not clearly delineated in computer documents. When a reader consults the file on his or her own computer, simply changing the font also changes the page breaks. One suggestion has been to count the paragraphs in a document—not an attractive option for any document that extends beyond a few pages. Perhaps someone will develop a software program to solve the problem. In the meantime, the advantage of an electronic document is that virtually any word processing program can search it in entirety to locate a particular topic or quotation.

Do They Fit?

At the beginning of this paper I asked, "Where do computer archives fit—or do they fit—into the framework of a literature search?" I have proceeded as if they do fit, as if computers should be used not only to find documents available in print, but also to locate computer files. Yet finding and retrieving electronic documents requires considerable time and persistence. Moreover, computer files in general and the Internet in particular are at present open forums, with few of the safeguards established in the scholarly community to deter publication of inaccurate or shoddy workmanship. These circumstances imply that a smaller percentage of finds will be usable than is the case with more traditional materials, at the cost of more time and trouble. So why bother to search for, or teach our students to search for, such items?

Like any other process, a literature search suffers from constraints. One has only so much time before a paper or report is due. A searcher may or may not have convenient online access. Thus, sensible prioritizing of search steps may sometimes preclude looking for computerized documents.

Yet I argue that while the Computer Workstation may be far in the future, even impossible as envisioned by the most optimistic computer-philes, something like it does lie ahead of us. It follows that educators should be able to lead their students in that direction.

Further, the safeguards we have built around print publications sometimes exclude important new ideas, as they limited opportunities for the early proponents of chaos theory (Gleick, 1987). At a time when truly new ideas, rather than tinkering, are sought by education professionals, the openness of the computer world may allow valuable ideas to bubble to the surface.

Computer access also opens new prospects for students. Many authors of electronic articles invite comments and questions from their readers. Indeed, a simple e-mail message may engender a response from a prominent educator who has limited time, yet finds pressing R for "reply" an easy, perhaps fascinating, maneuver.

Besides seeking advice and insights from leaders in a field, students can pose their own questions and comments in electronic discussion groups, with the potential intellectual stimulation such interchange may foster. They may even use "chat" programs to engage in real-time, online interaction with others who share their interests and concerns. The opportunity to participate in electronic debates at this AERA conference, and in follow-up discussion afterwards, from an Internet node anywhere in the world demonstrates the potentialities. So I conclude this article with suggestions on teaching students of education to search computer archives.

TEACHING ABOUT COMPUTER ARCHIVES

For at least two years I have been attempting to bring the full range of information resources, regardless of format or medium, into a single search strategy. Given my background in both library science and educational administration, I did not expect to encounter much difficulty in this task. However, the entire paraphernalia of information retrieval exists as it does largely by chance. Some person or organization was motivated to organize this or that set of information resources in this or that discipline for this or that purpose using this or that set of procedures. Of course, the resources themselves are even less organized than their indexes, catalogs, directories, and other bibliographic tools, because again, this or that person or organization was motivated to gather or express this or that information or idea, etc., etc.

Of course, these developers and organizers of information shared and borrowed ideas and approaches, and researchers have become familiar with existing "bibliographic control," as librarians refer to it, so that only occasionally do we become aware of the lacunae in the network. Consider, however, the field of educational administration. Even before computer documents added new dimensions to the task of searching the literature, anyone pursuing a comprehensive search faced a complex assignment.

Suppose one begins with ERIC. In this case the coverage in print and online is the same, with ERIC microfiche documents indexed since 1966 and journals since 1969. Search terms are readily found in the *Thesaurus of ERIC Descriptors*. The journal index portion of the ERIC database, *Current Index to Journals in Education*, covers 750 journals, nearly twice the number in *Education Index*. Why not stop there?

As it happens, one might skip *Education Index* in this case, since it does not analyze any administration journals that are not also in *CIJE*. We could perhaps overlook the fact that *Education Index* lists items virtually cover to cover, whereas *CIJE* reserves the right to be selective with the thought that surely *CIJE* would include anything really important.

However, for topics other than administration, *Education Index* might be a necessary stopping place, since among its 400 journals are 90 that are not covered in *CIJE*. Moreover, although *Education Index* is computerized only back to 1983, its print version carries us to 1929. So even for educational administration, any topic that reaches back beyond 1969 must push the searcher beyond *CIJE*. (And for something earlier than 1929? How about *The Reader's Guide to Periodical Literature*—1900 to date—and *Poole's Index to Periodical Literature*—1802 to 1906?)

For educational administration, there is another important resource: *Educational Administration Abstracts*. This service, available only in print, indexes and abstracts some 125 journals, of which 49 are not included in *CIJE*. All right (sigh), let us abandon ERIC and the computer and work with this abstract journal. Unfortunately, however, while *CIJE* omits those 49 serials, it includes 25 others that target management and policy, but do not appear in the abstract service.

Moreover, ERIC, *Education Index*, and *Educational Administration Abstracts* probably do not exhaust the journals on educational administration. Drawing from his experience at the Library of Congress, Thomas Mann writes, "It is sometimes amazing how much coverage of a particular subject is afforded by indexes outside the apparent boundaries of a specific discipline" (1993, p. 10). In the case of

educational administration, other relevant journal indexes include *Business Periodicals Index*, *Wilson Business Abstracts*, *ABI-Inform* (another business index), *PAIS* (Public Affairs Information Service) *International*, *Social Sciences Index*, and *Social Science Citation Index*. And this list still does not address books (for which I must consult *Library of Congress Subject Headings* rather than the *Thesaurus of ERIC Descriptors*), newspapers, pamphlets, government documents, audiovisual resources and, of course, computer files.

So the task of outlining a relatively simple and teachable sequence of search steps was far more difficult than I had anticipated. Nor am I, even now, fully satisfied with the result, which is summarized in the appendix to this paper. However, I am finding it teachable.

We are fortunate at Azusa Pacific University in that students have on-site and dial-in access to the university library and several databases. The university contracts with the Online Computer Library Center to offer about 40 computerized indexes. In addition, an Internet node has just been established, with faculty and doctoral students having first opportunity to obtain a password. Consequently, I find it easy to begin by requiring students to send, receive, and print out e-mail messages.

I am concerned that the course, an orientation to and preparation for doctoral study, not become a set of exercises in the computer lab. So although I set up online access, demonstrate in class, and sometimes allow students an hour or so during class to try out procedures that are giving them trouble, I also encourage them to call me at the office or at home whenever they run into problems.

Meanwhile, we begin to talk about search terms, focusing on the differences among subject headings, descriptors, and keywords. Students choose a topic, then develop a chart of search terms, separating (1) those used by ERIC from (2) Library of Congress (LC) subject headings, and these in turn from (3) terms that might be used by a writer on the subject, but are not standard entries for either ERIC or LC. We share and review these lists in class, after which students attempt to construct appropriate search strings. These, too, are shared and critiqued in class. Then we move into the second stage of the search process, finding citations. This stage is exemplified below. Since this paper focuses on computer archives, the two examples illustrate archie and Veronica, search tools available from most Internet access points.

archie

As noted earlier, archie (never capitalized) searches filenames and directories of Internet computers that offer files to the public. In the case of archie, my recommendation is an e-mail search, rather than "real-time" interaction, because the latter may take 15 minutes to an hour. Even at home, I would rather do other things while waiting for archie to answer e-mail than to tie up my computer and telephone for that length of time. Although the archie server may reply to e-mail by the end of a three-hour class, it may also wait until the next day. For this reason I always have the results of a previous search ready to show the class.

Although archie responds to forty different commands, I introduce only a few. I show students only what they need to know so as to obtain results from archie. Later, if they find themselves using archie often, students can download documents for more information.

First, we consider what it is that archie searches: filenames. Filenames on Internet computers are very compact. They are short. They rarely include spaces, although they may be interrupted by periods and hyphens. If the topic at hand has several synonyms, each must be tried in its turn, as archie does not perform Boolean (AND, OR, or NOT) searches. So the search term should be short.

One command I do introduce is SET SEARCH SUB. Given this command, archie searches for the desired word, whether or not other letters precede or follow. This has the effect of truncation. In other words, this search retrieves DISCIPLINE and DISCIPLINES and DISCIPLINED, and so on.

Let us suppose, then, that the desired search term is DISCIPLINE. I access the e-mail program at my Internet provider.

```
  PINE 3.89   MAIN MENU                          Folder: INBOX  0
Messages

        ?     HELP                 -  Get help using Pine
        C     COMPOSE MESSAGE      -  Compose and send a message
        I     FOLDER INDEX         -  View messages in current folder
        L     FOLDER LIST          -  Select a folder to view
        A     ADDRESS BOOK         -  Update address book
        S     SETUP                -  Configure or update Pine
        Q     QUIT                 -  Exit the Pine program


   Copyright 1989-1993.  PINE is a trademark of the University of
Washington.

? Help                        P PrevCmd                R RelNotes
O OTHER CMDS L [ListFldrs]    N NextCmd                K KBLock
```

I next select the nearest archie server and send it the following message.

```
  PINE 3.89   COMPOSE MESSAGE                          Folder: INBOX  0
Messages

To      : archie@archie.unl.edu
Cc      :
Attchmnt:
Subject :
----- Message Text -----

set search sub
find discipline
quit









^G Get Help  ^C Cancel  ^R Read File  ^Y Prev Pg  ^K Cut Text  ^O Postpone
^X Send      ^J Justify  ^W Where is  ^V Next Pg  ^U UnCut Text^T To Spell
```

Anywhere from ten minutes to a day later I receive in my e-mail box the reply shown on the following page. Note that some of the files seem to be duplicates of one another. Such duplication is common on the Internet, as systems operators at various locations copy onto their own computers those files that seem popular among their own clientele. This procedure reduces the burden on their own computer, because the file is more quickly transferred between computers on the same node, and of course also reduces the load on the Internet.

Examine the list on the next page. Some files are extremely short. Some deal with music, apparently offering the lyrics of a song. Some use the word "discipline" to mean a field of study, while the others may (or may not) relate to classroom management. This example illustrates nicely the disadvantages of keyword searching as opposed to subject heading or descriptor searching. It also demonstrates the limitations of filenames as an object of search.

By way of explanation, the first item is located on a computer with the address ftp.apple.com. The file was updated in September, 1994, although that may be the date on which it was copied to this computer, rather than the date on which it was created. Once connected to this ftp site, I can enter the command CD DTS/MAC/TOOLS, followed by the command GET DISCIPLINE. In most situations, the file will be transferred first to my Internet provider, from which I download it into my own machine.

Since students have already experienced e-mail, they should have no difficulty conducting an archie search. However, a demonstration and opportunity to try the file transfer procedure is necessary to complete the process.

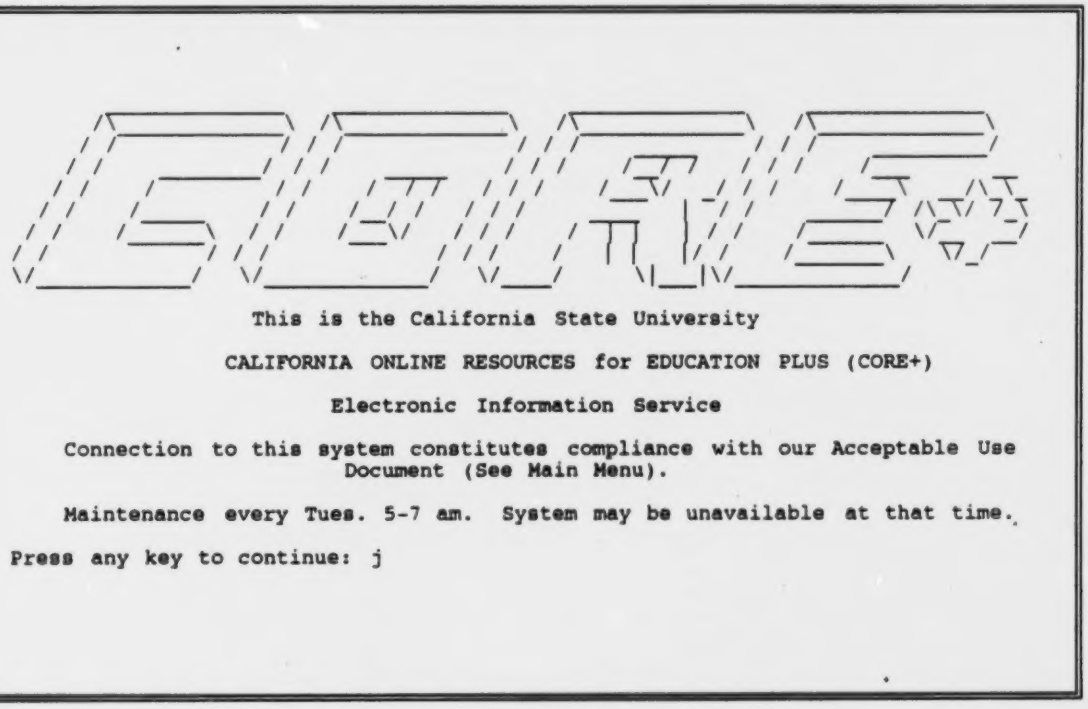
```
>> path <lwehmeye@CELLO.GINA.CALSTATE.EDU>
>> set search sub
>> prog discipline
# Search type: sub.

Host ftp.apple.com     (130.43.2.3)
Last updated 19:25  8 Sep 1994

    Location: /dts/mac/tools
      DIRECTORY     drwxr-xr-x      512 bytes   00:00 15 Sep 1992  discipline

Host ftp.uwp.edu     (131.210.1.4)
Last updated 15:26 10 Feb 1994

    Location: /pub/incoming/lists
      DIRECTORY     drwxrwxrwx      512 bytes   22:04  9 Jan 1994  discipline

    Location: /pub/music/lists
      DIRECTORY     drwxrwxr-x      512 bytes   11:17 23 Dec 1993  discipline

    Location: /pub/music/lyrics/k/king.crimson
      FILE     -rw-rw-r--     3256 bytes   00:00 24 Jan 1993  discipline

Host ftp.uu.net     (192.48.96.9)
Last updated 10:01 23 Jan 1994

    Location: /doc/music/bass/pub/incoming/lists
      DIRECTORY     drwxrwxr-x      512 bytes   00:42 29 Oct 1993  discipline

    Location: /doc/music/bass/pub/music/lists
      DIRECTORY     drwxrwxr-x      512 bytes   01:06 29 Oct 1993  discipline

Host ftp.uwp.edu     (131.210.1.4)
Last updated 15:26 10 Feb 1994

    Location: /pub/music/artists/k/king.crimson/mail.list   -> ../../../lists
      FILE     -rwxrwxrwx       25 bytes   23:00  7 May 1993  discipline

Host ftp.uu.net     (192.48.96.9)
Last updated 10:01 23 Jan 1994

    Location: /doc/music/bass/pub/music/artists/k/king.crimson/mail.list -> ../../../lists
      FILE     -rwxrwxrwx       25 bytes   01:34 29 Oct 1993  discipline

Host ftp.apple.com     (130.43.2.3)
Last updated 19:25  8 Sep 1994

    Location: /dts/mac/tools/discipline
      FILE     -rw-r--r--   175936 bytes   00:00 10 Aug 1991  discipline-2-0-1.hqx

Host ftp.uwp.edu     (131.210.1.4)
Last updated 15:26 10 Feb 1994

    Location: /pub/music/pictures/k/king.crimson
      FILE     -rwxrwxr-x    36379 bytes   00:00 31 Mar 1993  discipline.gif

Host ftp.cic.net     (192.131.22.5)
Last updated 13:28  8 Sep 1994

    Location: /pub/ETEXT/pub/Politics/Feminism/Conferences
      FILE    -rw-rw-r--    1416 bytes  15:28 11 Apr 1994  dialogues-across-disciplines.gz

Host etext.archive.umich.edu     (192.131.22.7)
Last updated 06:07  4 Jul 1994

    Location: /pub/Politics/Feminism/Conferences
      FILE    -rw-rw-r--    1416 bytes  15:28 11 Apr 1994  dialogues-across-disciplines.gz

>> quit
```

Veronica

A more congenial search tool is Veronica, which looks through Gopher menus. Since these menus consist of phrases in a more natural language structure than that of filenames, they are generally easier to search. Of course, each menu writer uses his or her own terminology, so the search still pulls up keywords, rather than consistent subject headings or descriptors. But Veronica accepts the Boolean commands AND, OR, and NOT as well as the asterisk for a truncation symbol. Most important, when Veronica is searched while online (and in this case e-mail is extremely cumbersome), the searcher may select any item that comes up and be connected to it immediately.

To demonstrate Veronica in class, I need a computer with modem, a live telephone line, and an LCD panel with overhead or some other way to project the computer screen so students can see what is happening. I usually ask students for a topic to search. However, I also have "canned" searches prepared from others done previously, just in case the system is down at class time. The following frames illustrate a Veronica search using the Gopher on CORE+, California's system for educators.

Suppose that we launch a Veronica search on restructuring. After logging on, I reach the opening screen for the CORE+ system.


This is the California State University
CALIFORNIA ONLINE RESOURCES for EDUCATION PLUS (CORE+)
Electronic Information Service
Connection to this system constitutes compliance with our Acceptable Use Document (See Main Menu).
Maintenance every Tues. 5-7 am. System may be unavailable at that time.
Press any key to continue: j

Next comes the main menu, on which I select item 1.

```
liwehmeCALIFORNIA  ONLINE RESOURCES for EDUCATION PLUS (CORE+)      03/24/95
Main Menu6:59 am

1.  CORE+ Electronic Services
2.  Unread News Items
3.  Request a CORE+ Account
4.  Unix System
5.  CORE+ Acceptable Use Policy

6.  Logoff CORE+



Up Arrow or Ctrl+K    = Move Upm = Main Menu  Down Arrow or Ctrl+J = Move Down
p = Previous Menu e= Logoff CORE+? = Help  1
```

Item 2, which refers to Gopher, is my next choice.

```
liwehmeCALIFORNIA  ONLINE RESOURCES for EDUCATION PLUS (CORE+)      03/24/95


1.  Overview of CORE+ Services
2.  Information Resources/Gopherspace
3.  Netnews/Conferences
4.  Lynx/WWW access
5.  CORE+ Databases
6.  Email
7.  Telnet/tn3270
8.  FTP
9.  Finger menu
10.  File Operations
11.  EIS Mail 2.1 (line mode)
12.  Directory of Users/User Configuration
13.  Internet Relay Chat client (IRC)

14.  Logoff CORE+

================================= ================================================
Your choice:  2
```

The next menu (following page) brings up the Gopher Client on CORE+.

```
Internet Gopher Information Client v2.0.16
Home Gopher server: bedstraw.calstate.edu

 -->   1.  Acceptable Use Policy
       2.  Tips on Using CORE
       3.  CORE Acknowledgements
       4.  News and Announcements/
       5.  CORE Information (Bulletin Boards)/
       6.  California Technology Information Project (CalTIP)/
       7.  California State University Information (CSUInfo) /
       8.  CSUPER-Net - CSU Campus and Admissions Info/
       9.  ERIC Services/
       10. CNN Daily Report/
       11. Additional File Retrieval Sites (FTP)/
      12. Additional Information Services (gopher sites)/
       13. Additional Information Sites (telnet)/
       14. CARL... Type in carl at the login prompt. <TEL>
       15. CORE Developments
       16. CORE Phone Book <CSO>
       17. CORE access numbers
       18. California Online Resources for Education's Netfind Server <TEL>

Press ? for Help, q to Quit                                    Page: 1/2
```

Here I press the space bar to move to the next page of the menu, where I find Veronica.

```
Internet Gopher Information Client v2.0.16
Home Gopher server: bedstraw.calstate.edu

       19. Clearinghouse of Subject-Oriented Internet Resource Guides (UMich)/
       20. Frequently Asked Questions on Copyright Laws/
       21. GINA Presentation (MAC Version)/
       22. Request a CORE+ Account... Type in coreplus at the login prom.. <TEL>
 -->   23. Veronica and Jughead Servers (search gopherspace)/









Press ? for Help, q to Quit                                    Page: 2/2
```

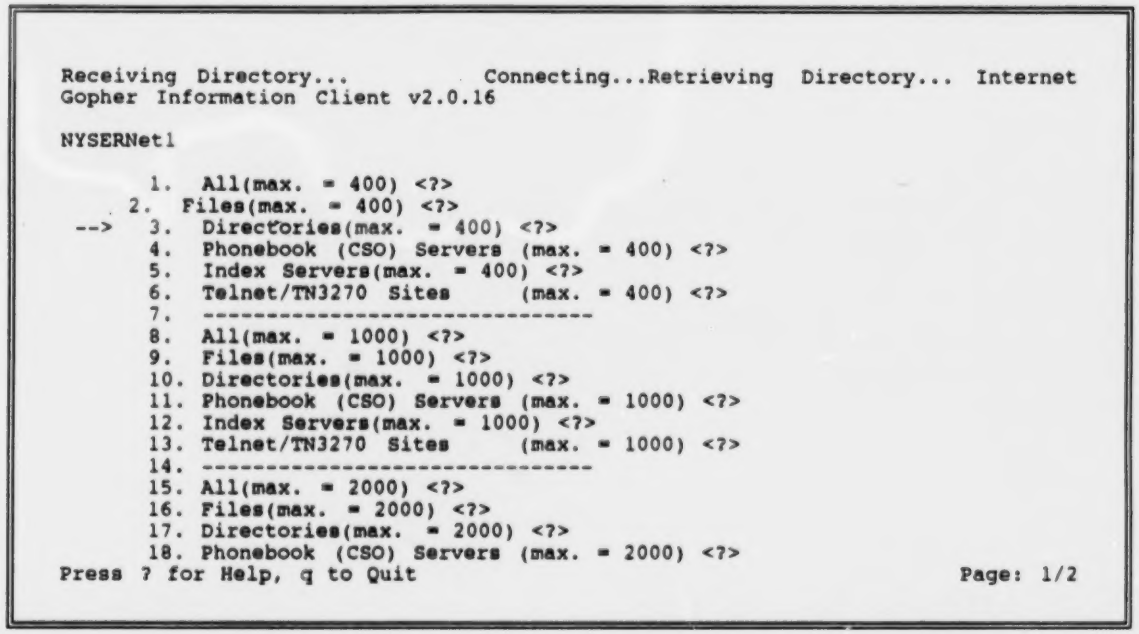
One more choice, and . . .

```
Receiving Directory...          Connecting...Retrieving  Directory...
Internet Gopher Information Client v2.0.16

Veronica and Jughead Servers (search gopherspace)

      1.  All Gopher Sites/
      2.  Search High-Level Gopher Menus by JUGHEAD at W&L <?>
      3.  Jugheads (& Similar) Non-Universal Gopher Site Indexes/
 -->  4.  Search Gopher Menus by VERONICA/
      5.  Gopher--News and Archives (from U Minn)/
      6.  Gophers--Subject Arranged/
      7.  What is Gopher? (University of Minnesota)/
      8.  jughead  [ 9Apr94, 3kb]




Press ? for Help, q to Quit                                    Page: 1/1
```

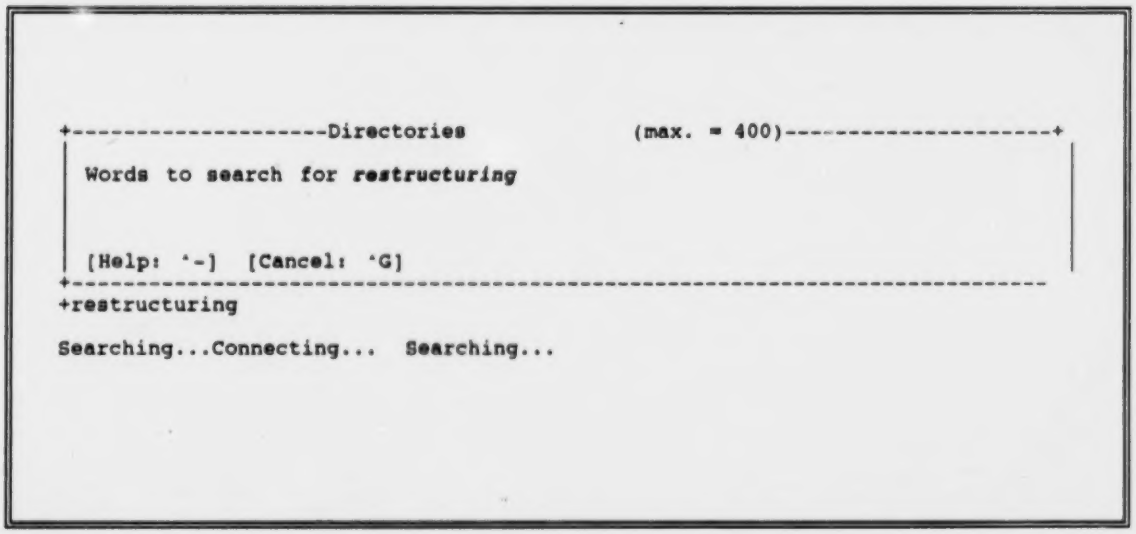
. . . at last I reach the Veronica menu.

```
Receiving Directory...          Connecting...Retrieving  Directory...
Internet Gopher Information Client v2.0.16

Search Gopher Menus by VERONICA

 -->  1.  NYSERNet1/
      2.  PSINet, Virginia1/
      3.  FONOROLA ..................  (Canadian Gopherspace)2/
      4.  University of Minnesota2/
      5.  Keio University ..........  (Japanese Gopherspace)3/
      6.  University of Manitoba3/
      7.  SUNET, Sweden5/
      8.  University of Bergen, Norway5/
      9.  Manchester University/
      11. veronica queries--How to, and FAQ (from Nevada)/

The    Servers    are    Sorted    by    Recent    Connection    Response    Time
------------------------------Other  Servers Did Not Connect (as at: Fri 09:26)

      15. AARNET ...................  (Australian Gopherspace)-/
      16. America Online-/
      17. SURFnet, Netherlands-/
      18. Tachyon Communications, Florida-/
Press ? for Help, q to Quit                                    Page: 1/2
```

Now I must choose whether to search the names of single files, the titles of directories into which files are gathered, or both. I select directories. There are fewer of them, and I want an idea as to how much material is out there.


Receiving Directory... Connecting...Retrieving Directory... Internet
Gopher Information Client v2.0.16
NYSERNet1
1. All(max. = 400) <?>
2. Files(max. = 400) <?>
--> 3. Directories(max. = 400) <?>
4. Phonebook (CSO) Servers (max. = 400) <?>
5. Index Servers(max. = 400) <?>
6. Telnet/TN3270 Sites (max. = 400) <?>
7. ---
8. All(max. = 1000) <?>
9. Files(max. = 1000) <?>
10. Directories(max. = 1000) <?>
11. Phonebook (CSO) Servers (max. = 1000) <?>
12. Index Servers(max. = 1000) <?>
13. Telnet/TN3270 Sites (max. = 1000) <?>
14. ---
15. All(max. = 2000) <?>
16. Files(max. = 2000) <?>
17. Directories(max. = 2000) <?>
18. Phonebook (CSO) Servers (max. = 2000) <?>
Press ? for Help, q to Quit
Page: 1/2

Next the computer presents me with a window or dialog box into which I type RESTRUCTURING, the search term. Veronica would accept RESTRUCTUR* or even something like (RESTRUCTUR* OR SITE-BASED OR (SHARED DECISION*)). However, on this first demonstration, my purpose is to focus on Veronica, rather than on elaborate search strings.



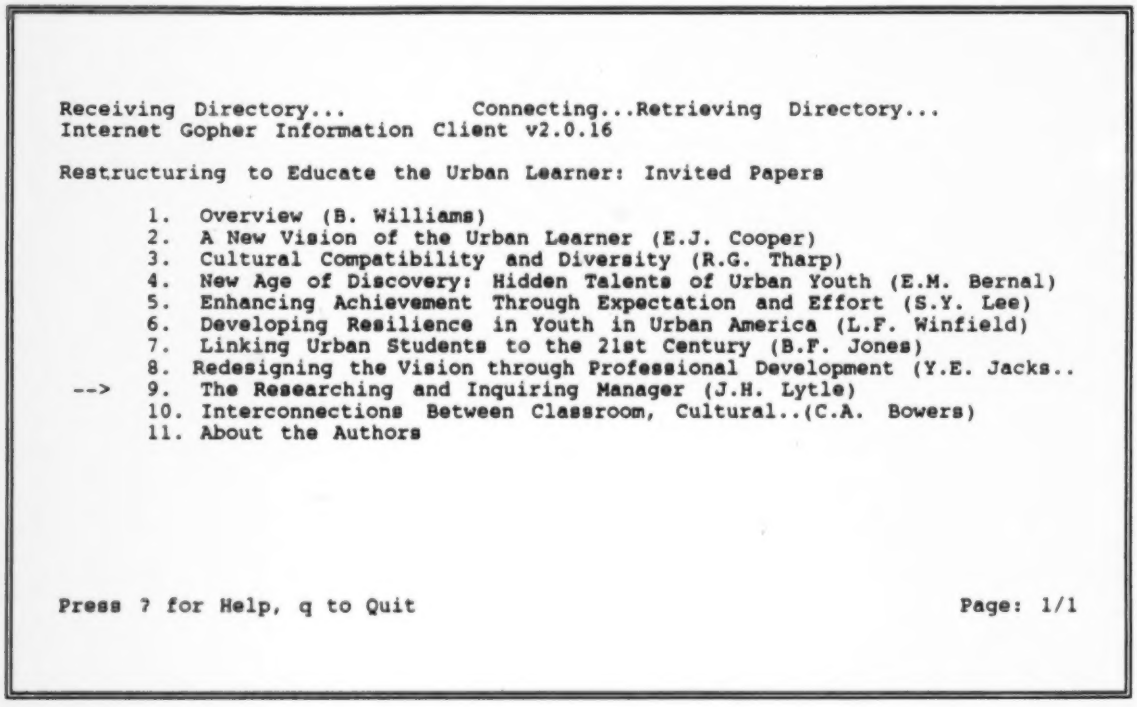
The search is set to retrieve a maximum of 400 items, but in fact 51 are collected. However, these are directories, each of which may contain a large number of files. Here is the first screen of the three showing the results of the Veronica search.

```
Internet Gopher Information Client v2.0.16

Directories(max. = 400): restructuring

      1.  Economic Restructuring/
      2.  194I. Restructuring Hegemony in the World Economy. S/
      3.  Restructuring Reports/
      4.  Oversight Committee on Restructuring/
      5.  Restructuring Virginia Tech: A Report to the State (Aug 1994)/
      6.  3. Actions and Initiatives Supporting Restructuring/
      7.  Restructuring/
      8.  Interdivisional Collaboration and Restructuring/
      9.  STEPHEN B. BUNKER & PAUL S. CICCANTELL, Restructuring Markets, /
      10. Restructuring Plan for the College of William and Mary/
      11. Teleconference on K-12 Technology and Restructuring/
      12. 6.  Restructuring Proposals/
      13. Electric Restructuring Forum/
      14. Restructuring Plan/
      15. School Restructuring Consortium/
      16.  Preliminary Restructuring Task Force Reports/
      17.  Final Restructuring Task Force Reports/
      18. Restructuring/

Press ? for Help, q to Quit                                    Page: 1/3
```

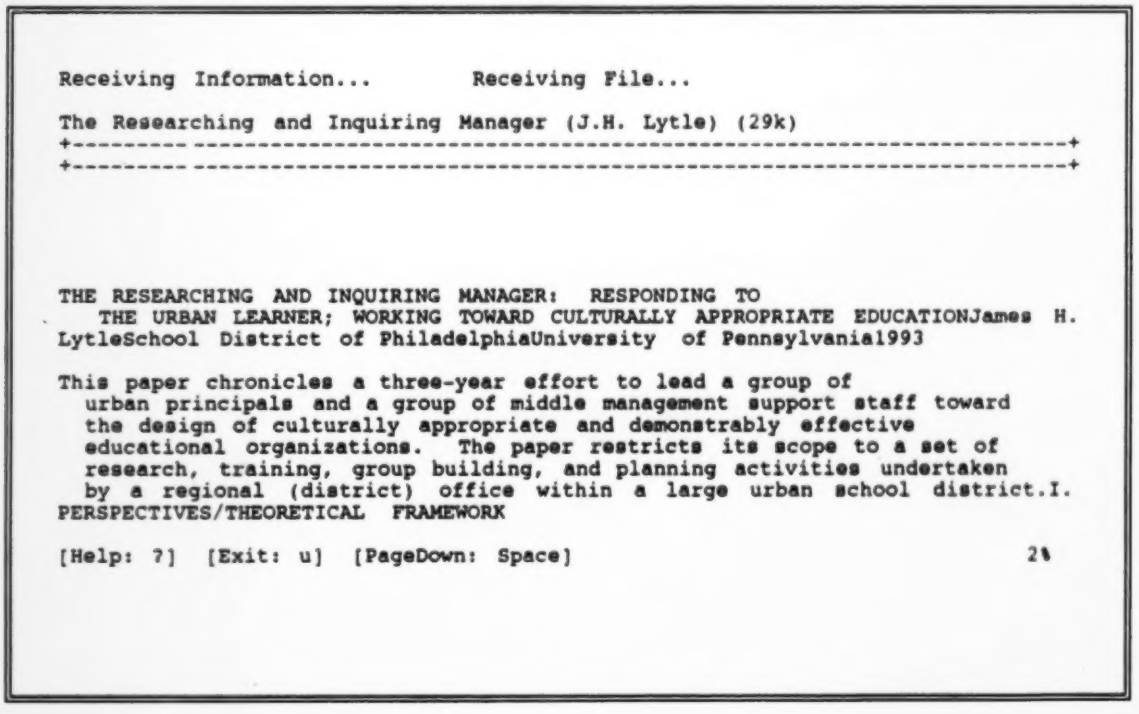
The / at the end of these items reminds me that they are directories. Unlike archie, which only tells me where to obtain documents of interest, Veronica connects me immediately to the directory, wherever in the world it may be. I decide to begin by choosing item 37 on the third screen:

--> 37. Restructuring to Educate the Urban Learner: Invited Papers /

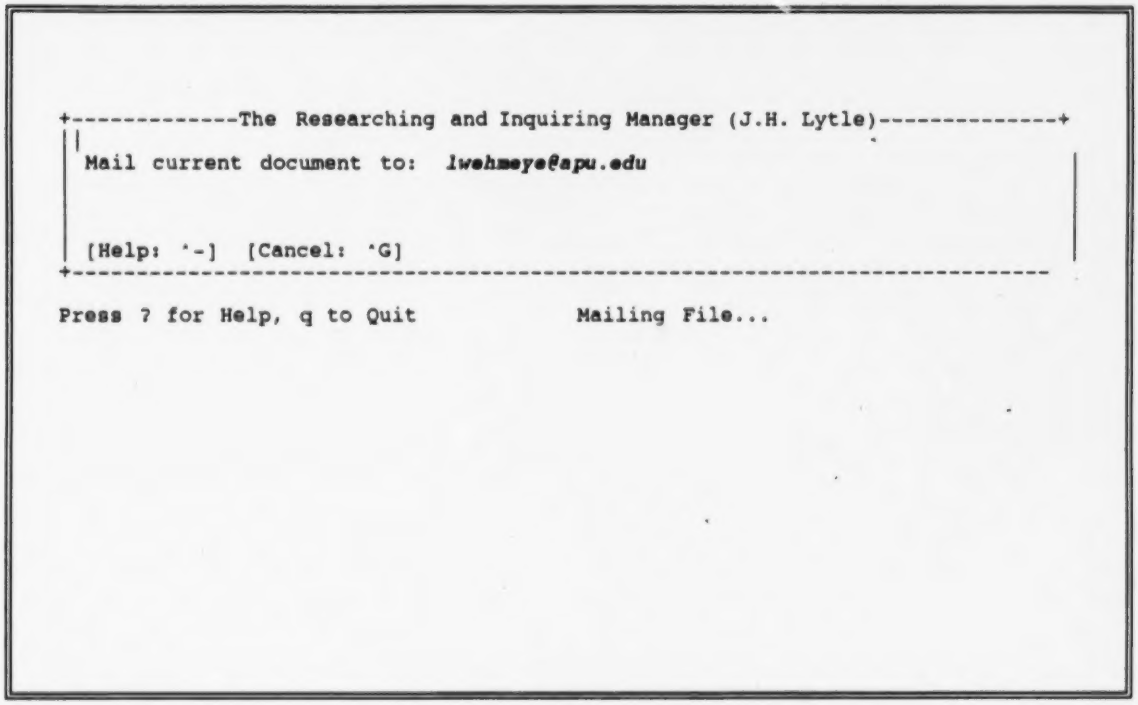
I find a collection of ten papers.


Receiving Directory... Connecting...Retrieving Directory...
Internet Gopher Information Client v2.0.16
Restructuring to Educate the Urban Learner: Invited Papers
1. Overview (B. Williams)
2. A New Vision of the Urban Learner (E.J. Cooper)
3. Cultural Compatibility and Diversity (R.G. Tharp)
4. New Age of Discovery: Hidden Talents of Urban Youth (E.M. Bernal)
5. Enhancing Achievement Through Expectation and Effort (S.Y. Lee)
6. Developing Resilience in Youth in Urban America (L.F. Winfield)
7. Linking Urban Students to the 21st Century (B.F. Jones)
8. Redesigning the Vision through Professional Development (Y.E. Jacks..
--> 9. The Researching and Inquiring Manager (J.H. Lytle)
10. Interconnections Between Classroom, Cultural..(C.A. Bowers)
11. About the Authors
Press ? for Help, q to Quit
Page: 1/1

Since my students are in educational administration, item 9 looks particularly interesting. When I select it, the text comes up on the computer screen.


Receiving Information... Receiving File...
The Researching and Inquiring Manager (J.H. Lytle) (29k)
THE RESEARCHING AND INQUIRING MANAGER: RESPONDING TO
THE URBAN LEARNER; WORKING TOWARD CULTURALLY APPROPRIATE EDUCATIONJames H.
LytleSchool District of PhiladelphiaUniversity of Pennsylvania1993
This paper chronicles a three-year effort to lead a group of
urban principals and a group of middle management support staff toward
the design of culturally appropriate and demonstrably effective
educational organizations. The paper restricts its scope to a set of
research, training, group building, and planning activities undertaken
by a regional (district) office within a large urban school district.I.
PERSPECTIVES/THEORETICAL FRAMEWORK
[Help: ?] [Exit: u] [PageDown: Space]

Although the "mail" command does not show on the screen, I know that it is the letter "m." I could quit this document and the mail command would show on the screen. However, I took a shortcut and just pressed m--and the following box came up. I typed in my e-mail address.


+-------------The Researching and Inquiring Manager (J.H. Lytle)--------------+
Mail current document to: lwehmeye@apu.edu
[Help: ^-] [Cancel: ^G]
+---
Press ? for Help, q to Quit
Mailing File...

Within a minute or so, the file shows up in my Internet e-mail box. Other options exist for retrieving the file, but unless my computer is tied directly to an Internet node, e-mail is the easiest choice.

Because I present the literature search as a single process, integrating print and nonprint sources, some students may feel overwhelmed. For their first major assignment, therefore, students are asked to choose a topic, perhaps one they are contemplating for dissertation research, and try just one tool for each search step. In this way they gain an overview of literature searching, have at least a bit of experience with each aspect of the process, and are equipped to set priorities for future searches.

APPENDIX: SEARCH STEPS

The search process described here leans toward the practical, rather than the theoretical. For example, "using ERIC" should scarcely appear as a separate step, since the second search stage, "finding citations," is otherwise organized by the format of the material sought. ERIC, on the other hand, is a search tool, a database produced by the Educational Resources Information Center. Practically speaking, however, using the ERIC database by computer is more efficient than working through the printed volumes. And on computer, the database usually combines the material from *Research in Education*, index to ERIC's collection of microfiche documents (which go with step 2.1), and *Current Index to Journals in Education* (which goes with step 2.5). Thus the rationale for Step 2.3.

1. GENERATING SEARCH STRINGS

    1.1 Listing search terms
    1.2 Creating search strings

2. FINDING CITATIONS

    2.1 ... in bibliographies
    2.2 ... for stand-alone documents (books, monographs, papers)
    2.3 Using ERIC
    2.4 Choosing indexes
    2.5 Finding citations for contents of documents (journal and news articles, essays)
    2.6 ... for specialized documents(government documents, pamphlets, tests)
    2.7 ... for computer documents on commercial services
    2.8 ... for computer documents on the Internet
    2.9 Finding databases for secondary research
    2.10 ... audiovisual resources
    2.11 ... computer software
    2.12 ... organizations and individuals

3. RETRIEVING RESOURCES

    3.1 Retrieving fulltext on paper
    3.2 ... fulltext on computer
    3.3 ... media
    3.4 Contacting people

Source: *The Educator's Information Highway*, Techmonic, 1995 (in press).

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Comments to lwehmeyc@apu.edu.